

JOHNS HOPKINS UNIVERSITY CIRCULARS

Published with the approbation of the Board of Trustees

VOL. XIX.—No. 143.]

BALTIMORE, MARCH, 1900.

[PRICE, 10 CENTS.]

REPORT OF A SPECIAL COMMISSION SENT TO THE PHILIPPINES BY THE JOHNS HOPKINS UNIVERSITY TO INVESTIGATE THE PREVALENT DISEASES OF THE ISLANDS.

BY PROFESSOR S. FLEXNER, M. D., AND PROFESSOR L. F. BARKER, M. D.

REPORT UPON AN EXPEDITION SENT BY THE JOHNS HOPKINS UNIVERSITY TO INVESTIGATE THE PREVALENT DISEASES IN THE PHILIPPINES.

TO PRESIDENT GILMAN, DOCTORS WELCH AND OSLER,
Philippine Committee of the Johns Hopkins University Medical School.

Gentlemen:—We have the honor to submit to you a brief account of our work and movements in carrying out your commission to study the prevalent diseases in the Philippine Archipelago. Your commissioners, consisting of Dr. Simon Flexner and Dr. L. F. Barker, to whom were voluntarily attached Messrs. J. M. Flint and F. P. Gay, of the Medical School, the latter having given their time and paid all their own expenses, sailed from Vancouver on March 29th, 1899, and arrived in Manila May 4th, where they immediately established themselves for the purpose of the work mentioned. Owing to the military situation it was found impracticable to visit other ports in the Archipelago or to penetrate into the interior of the Island of Luzon. The entire time, therefore, of the commission was spent in the study of disease existing among the natives and American troops in Manila and at Cavite.

WORK IN JAPAN AND HONG-KONG.

As transport sailings were uncertain and the passage out by them slow, it was decided to save time and go by fast steamer, the Canadian Pacific Railway giving especial rates to the commission on tickets around the world.

The original plan of your commissioners was to proceed directly to Manila by way of Hong-Kong, at which latter port it was intended to stop only long enough to outfit for the tropics and to catch the earliest steamer sailing for Manila. After consideration of the probability that certain new kinds or phases of disease, not occurring in temperate regions, might be encountered in the Archipelago, and of the fact that the diseases of the Philippines would probably have much in common with those of Japan, it was decided to spend one week in Japan, where modern hospitals could be visited and advantage taken of the results of the study of tropical disease by highly trained and eminent Japanese physicians. The decision proved to be valuable in many ways; and we especially desire to express our obligations to Professors Aoyama, Mitsukuri, Miura and Kitasato, who showed us many courtesies. The opportunity to see in the Japanese hospitals pure

and mixed examples of beri-beri assisted us greatly in our subsequent studies, as did also the observations on dysentery made in the Institute for Infectious Diseases at Tokio.

While outfitting at Hong-Kong we improved the opportunity to study the bubonic plague, which was still prevailing at that port. This study was made easy by the generosity and courtesy of the English Civil Physician, Dr. James Lowson, in charge of the Plague Hospital and Mortuary. The study began in this way was extended when two months later we returned to Hong-Kong, en route to America. At this time a considerable exacerbation of the disease had taken place, and within a week or ten days we saw several scores of cases and performed many autopsies. The several forms of infection: inguinal; axillary; tonsillar and cervical and pulmonary, were thus encountered. Bacteriological examinations were made and tissues collected for future study. Two of the party (Dr. Barker and Mr. Flint) spent on the return journey three weeks (at their own expense) in India, where the great epidemics of plague there raging were observed.

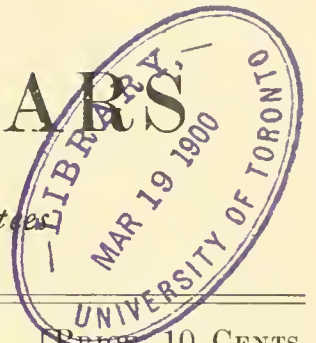
ARRIVAL IN MANILA.

Immediately upon our arrival in Manila quarters were sought at the "Hotel de Oriente." Very insufficient accommodations were secured for a limited time, as the sudden accession of families of Army and Naval officers had strained the hotel to its fullest capacity. Having been forewarned of the conditions of living in Manila, we took the precaution to bring with us from Hong-Kong a group of Chinese servants, intending to set up house-keeping if practicable. After much difficulty a small house was secured in San Miguel, where, by hiring parts of the furnishings and buying what could not be rented, a temporary establishment was secured.

Within a few hours after our arrival the credentials and private letters brought were presented to Colonel Woodhull, Surgeon-in-Chief to the 8th Army Corps and to General Otis. Colonel Woodhull afforded us every opportunity to prosecute our work in the military hospitals. Although no special introduction was in our possession, we quickly met Dr. Bourne, chief health officer of Manila, who opened to us the hospitals under his charge. Somewhat later we met Dr. Pearson, Chief Naval Surgeon, who opened the Naval Hospital at Cavite to us.

HOSPITALS IN MANILA.

Civil Hospitals. These consist of a large hospital within the walled city, *San Juan de Dios*. It has a capacity of from 250 to 300 beds and accommodated during our stay both natives and Europeans. The number of Euro-



pean patients was small. When the military hospitals were much crowded a certain number of wounded prisoners of war were accommodated. The hospital contained chiefly native medical cases of both sexes. The *San Lazaro* or leper hospital, in the outskirts of Manila, contained from 80 to 100 lepers during our stay. These had come from Luzon, almost exclusively from Manila and its immediate surroundings. The two sexes are provided or in separate, large and airy wards. One wing of the building, having a private entrance, is devoted to native prostitutes who apply regularly for examination and are incarcerated here and treated medically when found to be suffering from venereal disease.

Military Hospitals. These consisted, beside the regimental hospitals which were virtually detention camps, of three Reserve Hospitals—the 1st, 2nd and 3rd Reserve Hospitals; a convalescent hospital on Corregidor Island and the Hospital Ship *Relief*, which was anchored in the bay. The First Reserve Hospital, under the control of Major Crosby, had been originally the Spanish military hospital. It had been from time to time, by the erection of tents over platforms raised a foot or two from the ground, increased in capacity until in July it contained 1200 or more beds. The Second Reserve Hospital, under the control of Major Keefer, was a transformed modern school building and because of its limited capacity (250 beds), high ceilings and wide corridors it made a model hospital. The Third Reserve Hospital had just been established towards the end of our visit and was smaller than the others and intended as a convalescent hospital. The hospital at Corregidor is a temporary structure and intended for convalescents. It is especially well adapted for its purpose because of the high and hilly character of the island and its complete investment by the sea. The *Relief* was used as a hospital for acute cases; but some time before we left the acute cases were transferred to the Reserve Hospitals and the *Relief* sailed for San Francisco with invalided men.

The Reserve Hospitals accommodated especially American sick and wounded; but a ward in the First Reserve Hospital was set aside for the Filipino wounded.

After the outbreak of beri-beri at Cavite a hospital under military control was established at San Roque in the remains of the Spanish Marine Hospital which had been wrecked by the insurgents.

Naval Hospital. A small hospital for sick seamen and marines was established at Cavite. Through the courtesy of Dr. Pearson this was open to us for clinical studies.

Clinical, Pathological and Bacteriological Laboratory. Through the kindness of Colonel Woodhull and Major Crosby, the officer-in-chief of the First Reserve Hospital, a small Filipino house, situated on the banks of the Pasig, was given us in which to establish a laboratory. This was done on the second floor of the house. The expense of putting up working-tables kindly borne by the Medical Corps of the Army. The laboratory equipment was set up in this building and within a very few days after our arrival work was begun. We desire to speak of the co-operation of the Medical Staff of the hospital who afforded us every opportunity to visit the wards and many of whom joined or assisted us in clinical and pathological work. We wish especially to acknowledge the co-operation and assistance of Lieut. Richard P. Strong, a graduate of the J. H. U. Medical School, who had on our arrival already begun to do laboratory work and who gave up much of his valuable time in furthering our interests. It was found unnecessary to establish laboratories in the other hospitals, in the first place because all were connected with the First Reserve by the Signal Service telegraphic system of which we had free use; and next because all the dead were carried to the morgue in conjunction with the First Reserve Hospital. We went or were frequently called to the other hospitals to make clinical and bacteriological examinations.

With few exceptions, all the dead were subject to autopsy. Postmortem examinations were made at the Civil Hospitals upon natives and at the Military Hospital upon all that died. Exceptions were made only in the cases of those dead from gunshot wounds, when, if pressed for time, necropsies were sometimes omitted.

PREVAILING DISEASES.

The subject of the prevalent diseases may be considered as they affect (1) the natives, and (2) Europeans and Americans, especially the American garrison.

Diseases affecting Natives. (a) *Skin Diseases.* Of the skin diseases prevailing among the natives, aside from small-pox and other specific exanth-

mata, may be mentioned (1) diseases of the scalp, which are very frequent (2) dhobie itch; and (3) an affection which resembles closely and which is probably identical with Aleppo boil (Delhi boil, Biskra button, *epidemische Beulenkrankheit*). (b) *Small-Pox.* This disease has been so generally prevalent in Luzon that the natives have to a large extent lost fear of it. All evidence points to the greatest carelessness in preventing its spread during Spanish times. Isolation of the sick and disinfection of the habitations seem not to have been attempted, and vaccination, even among the Spanish garrison, had not been carried out. Under these circumstances it could be no surprise that after the American occupation the disease should appear and even become epidemic. The epidemic which appeared early last year was promptly met by Dr. Bourne, who caused the Spanish garrison still in Manila and the natives and Chinese within the city to be vaccinated. In order to insure satisfactory results he found it necessary to establish a vaccine farm in which young *carabao* were used for the preparation of the virus. Under the influence of this measure and by the aid of isolation of the sick the disease had in May practically disappeared within the military lines about Manila. (c) *Leprosy.* A definite focus of this disease exists in Luzon. The cases, in the neighborhood of 100, which were confined in the San Lazaro Hospital came from Manila and the country immediately surrounding that city. The disease affected both sexes, being more frequent in adults, although also present in half-grown boys and girls. The commonest forms were the tubercular and mutilating. Autopsies were performed upon several cases that had died during our stay. (d) *Tuberculosis.* Accurate statistics of the extent of the prevalence of this disease are difficult if not impossible to obtain. That the disease is a common one is indicated by several facts. It is frequently met with in the native hospitals, where it may have been recognized during life or is disclosed at autopsy. Many cases of supposed beri-beri which we autopsied at San Juan de Dios proved to be tuberculosis. It is possible that the two diseases had co-existed, for we found such combinations freely recognized by Japanese physicians in the hospitals in Japan. Tuberculosis of the lungs was also found as a common complication in leprosy individuals that came to autopsy. A not very infrequent spectacle met with on the streets are much emaciated and weak natives, affected with suggestive coughs and free expectoration. While it is not certain that these individuals were examples of tuberculosis, there is strong probability that this explanation of their condition is the correct one. (e) *Venereal Disease.* Syphilis, by general agreement (statistics not available), does not prevail unduly. Chancre and gonorrhoea are, on the other hand, very common. The majority of the prostitutes confined in the San Lazaro were victims of these two diseases. A very common complication of the soft sore, owing to lack of cleanliness, is swelling and suppuration of the inguinal glands. (f) *Beri-Beri.* This disease is well known among the natives. It would appear to be epidemic and endemic in Luzon. It is, judging from cases met with in San Juan de Dios Hospital and the statements of native physicians, constantly appearing in a sporadic form. During our stay an epidemic appeared among the Filipino prisoners confined at Cavite. Some 200 cases developed in a few weeks; the mortality ranged from 20 to 30 per cent. The several recognized forms of the disease—oedematous, paralytic, and mixed—were encountered. Clinical and bacteriological studies were made upon the living, and the dead were subjected to autopsy and bacteriological examination. The difficulty of getting to and fro between Manila and Cavite on account of the impossibility of land communication, made this part of our work difficult and time-consuming. A considerable collection of pathological material and other data has been made. This material is now in process of study and arrangement.

Diseases affecting Americans. The chief causes of disability among the American land forces are the enteric diseases. These are diarrhoea, dysentery, typhoid fever, and gastro-intestinal catarrhs. Many of the diarrhoeas are merely preliminary to the symptoms of dysentery. Other infectious fevers are relatively infrequent. A small number of cases of scarlet fever and diphtheria only were encountered. The malarial fevers prevailed but not seriously during the months of May, June, and July. (a) *Dysentery.* This disease is responsible for the greatest amount of invalidation and the highest mortality. It appears in acute, sub-acute, and chronic forms. The chronic form is sometimes attended by secondary abscess of the liver. The acute form may end in 24, 48, or 72 hours. In it the whole of the large intestine and usually the lower portion of the ileum is involved. The

mucous membrane of the gut is swollen, congested and oedematous, in places haemorrhages have taken place into the mucous membrane and the sub-mucosa is swollen and its blood-vessels greatly dilated. No ulcers existed in such cases. Amoebae were absent or very difficult to find in the fresh stools and in the intestinal contents immediately after death. In the sub-acute and chronic forms ulcers are present in the mucosa; the coats of the intestine are greatly thickened; at times large sloughs of mucous membrane, partly detached, occur, and the lesions are confined to the large intestine. Amoebae are more commonly present in these cases but are variable as to actual occurrence and numbers. Large hepatic abscesses, usually single, were encountered in a number of these cases. Amoebae were variable in the contents of the abscesses. In one very large abscess, occupying both right and left lobes of the liver, no amoebae but a pure culture of the *Staphylococcus pyogenes citreus* was obtained. The clinical study of the cases of dysentery with reference to amoebae was equally unsatisfactory. In cases with marked symptoms both in patients confined to bed and those beginning to go about but still with persistent loose bowels, these organisms were frequently missed; while in instances ready to be discharged they might, at certain examinations, be found to be very abundant. In morphology, the amoebae studied corresponded with the amoeba coli found in Egypt and in this country. The bacteriological study of cases of dysentery was carried out upon the fresh stools of acute and chronic cases and with the intestinal contents, mesenteric glands, liver, etc., of cases dying and subjected to autopsy. The intestinal flora was studied in its entirety by means of plate cultures. A variety of microorganisms were separated. Many of these were well-known species or occurred normally in the situations in which found. Tests with blood sera for agglutination were made and those organisms giving positive reactions were separated for further study. Two groups of bacilli were thus differentiated: (1) Having affinities with the group of bacillus coli communis. The agglutination was variable, being constant and sensitive with the blood-serum of the same individual (host) and inconstant, and active in relatively strong solutions only, in serum from other individuals. (2) Having affinities with the group of bacilli of which the *Bacillus typhosus* is the type. Agglutination constant and sensitive with blood-serum of host as well as the sera of other individuals suffering from dysentery. Inactive with normal serum, serum from cases of typhoid fever, malaria and beriberi. A bacillus belonging to the second group, which is still under study, would seem to agree with the bacillus dysenteriae isolated by Shiga from cases of endemic dysentery occurring in Japan. It is regarded by us as an important factor in the causation of the dysentery of the Philippine Islands. Experiments in immunization of animals and the production of vaccine are in progress. (b) *Typhoid Fever*. The total number of cases of typhoid fever in the hospitals during May, June and July was far below those of dysentery; the number of deaths also was less. It was, however, a frequent affliction among Americans. The examination of the blood, microscopically and with the Widal test, was of the greatest help in diagnosis. The disease came to autopsy presenting the classical intestinal lesions and also in atypical forms. In the small number of autopsies made upon those dead of this disease, several instances of slight intestinal involvement or even entire escape were met with. These cases would have remained very obscure or even undetermined except for the Widal reaction and bacteriological examination. In some instances the typhoid bacillus was found widely disseminated throughout the body, the autopsy being made immediately after death. (c) *Malarial Fevers*. A large proportion of the cases sent in from the field and outlying military stations where examinations had to be hastily made as instances of "malaria" or "intermittent fever" turned out to be cases of other diseases (typhoid fever, dysentery, etc.). A number of true cases of malarial fever were, however, met with, and in the blood of these the characteristic parasites, identical with those occurring in other places in which studies of the blood have been made, were found. No quartan parasites were met with, but cases of quartan affection doubtless exist. Typical infections with the "tertian" and "aestivo autumnal" varieties of the parasite were encountered by us, and by microscopists among the Army physicians in the Reserve Hospitals and on the *Relief*. One of the fatal cases of malaria was complicated with acute lobar pneumonia. The cases of "calentura pernicioso" which occur in Mindoro, Mindanao and in certain parts of Luzon should be studied as soon as these regions are accessible. The Archipelago is favorable also for the study of the relation of mosquitos

and other insects to malarial infection. Some of the malarial cases were undoubtedly *recidives*, imported from Cuba or elsewhere. A very small number of deaths was referable to malaria. Two instances of acute malarial infection came to us for autopsy. On the other hand, several instances of malarial pigmentations of the organs, in persons dying from other diseases, were encountered. Parasites in the latter cases were absent. These men had, as a rule, been in Cuba or Porto Rico during the Spanish war.

(d) *Tuberculosis*. A number of cases of pulmonary tuberculosis developed among the soldiers in the American troops. A definite history of exposure to wet and various hardships was elicitable in many of these cases.

(e) *Dengue*. At Cavite there occurred a large outbreak of an epidemic fever of short duration (a few days) known locally as Cavite fever. Almost all who remained in Cavite for any length of time were attacked. Second and third attacks were common. Muscular pains were severe in some cases and not in others. A slight exanthem was present in many of the cases. Flushing of the face, restlessness and general malaise accompanied the fever and rapid heart action. Malarial parasites were not present in the blood, nor did the serum from such cases agglutinate cultures of the typhoid bacillus. The epidemic is regarded as one of Dengue.

(f) *Tropical Ulcers*. A number of the American soldiers suffered from a form of indolent ulceration, locally known as "tropical ulcer." These ulcers occurred singly sometimes but were more often multiple. They began as small pustules, which gradually extended. They were most frequent among those who had been compelled to make long marches through swampy districts, and the patients themselves attributed the ulceration to "poisoning" in the marshes.

(g) *Wound Infection*. Our experience with wound infections was rather limited. The other problems undertaken, regarded as more important as bearing on the general question of disease and its causation in the Islands, left but little time and opportunity to attack this interesting subject. Certain observations of interest were made. Pyogenic infections due to the common pus cocci occurred. In a small number of gun-shot wounds causing compound fractures emphysematous gangrene occurred and the bacillus aerogenes capsulatus was isolated. In one instance of compound fracture of the tibia a spore-bearing bacillus was associated with the bacillus aerogenes capsulatus. It was found in cover-slip preparations from the original wound and in the first set of cultures. It could not be further transplanted and hence was not identified. In two other cases was the bacillus aerogenes met with, one a case of peritonitis following infection of the intestine from an incarcerated hernia, and the other also a case of peritonitis but secondary to perforation of a typhoid ulcer of the intestine. The army surgeons were enthusiastic as to the adequacy of the "First-Aid Package" in limiting the number of wound infections.

CLIMATOLOGICAL AND HYGIENIC CONDITIONS.

The climate is that of continual summer. There is a wet season (S. W. Monsoon) and a dry season (N. E. Monsoon). The hottest period is at the end of the dry and the beginning of the wet season—precisely the period of our visit. The climate from November to March is said to be delightful. In the worst season of the year the climate is very trying and especial precautions are to be taken if Americans are to keep well there. The extremes of temperature are not great, but the constancy of the high temperature, together with a high degree of humidity, make the climate peculiarly enervating. We were interviewed at length while in Manila, officially by the U. S. Philippine Commission, with regard to climate and the hygienic precautions to be observed, as well as with regard to other medical problems in the islands. The climatic conditions and the hygienic precautions to be taken will form the subject of a fuller report to be made later.

The above represents, briefly stated, the results achieved by your expedition sent to the Philippines. As will be patent to you, not a little yet remains to be done before the scientific portion of the work is completed. This portion of the report is for the present only hinted at or withheld until it shall have been finished. It is the intention of your commissioners to make careful studies of the material relating to beriberi, dysentery, malarial and typhoid fevers, leprosy, and the bubonic plague, which has been collected. These studies, with the exception of that relating to dysentery, will be carried out upon preserved material, and the labor involved, which has been divided between Baltimore and Philadelphia, will necessitate that some time must elapse before the finished report is

forthcoming. The task of completing the study of the bacillus isolated from cases of dysentery has been assigned to Dr. Flexner, who was principally engaged with that theme during the residence in Manila. In order to carry out the experiments as designed, an outlay for experimental animals and their maintenance will need to be made. It is known to you that the original sum so generously contributed by friends of the University and appropriated for the use of your commission has been exhausted, and that private means have been drawn upon to defray a part of the expense involved. We would respectfully draw attention to this fact and to the further expenses to be incurred, and request direction as to your wishes regarding these matters.

We wish to express our deep gratitude to Messrs. Flint and Gay, whose untiring efforts during our residence in Manila made it possible to accomplish far more than we could have done unaided. It is a pleasure to acknowledge also many kindnesses on the part of Mr. John W. Garrett.

That we are deeply indebted to the officers in the Medical Service of the U. S. Army and Navy for opportunities and aid is evident from the report preceding. Courtesies and kindnesses extended by various citizens of Manila, European and native, are here also gratefully acknowledged.

Very respectfully,

SIMON FLEXNER,
LEWELLYS F. BARKER.

PROCEEDINGS OF SOCIETIES.

Scientific Association.

December 21, 1899.—One hundred and forty-sixth regular meeting. Professor Remsen in the chair.

Papers read:

The Diseases of the Philippine Islands. By L. F. BARKER.
The Inheritance of Deafness. By W. K. BROOKS.

January 10, 1900.—The annual business meeting, at which the following officers were elected:

President.—IRA REMSEN.
Vice-President.—W. K. BROOKS.
Secretary.—J. ELLIOTT GILPIN.

January 18.—One hundred and forty-seventh regular meeting. Professor Remsen in the chair.

Paper read:

The Life of James Dwight Dana. By D. C. GILMAN.

January 29.—One hundred and forty-eighth regular meeting.

Address by Professor R. W. WOOD, of the University of Wisconsin.
"Photographs of Sound Waves," and "Color Photography."

February 15.—One hundred and forty-ninth regular meeting. Professor Remsen in the chair.

Papers read:

Permanganic Acid by Electrolysis. By J. C. OLSEN.
The Physical and Chemical Properties of Radio-active substances. By W. J. A. BLISS and C. E. CASPARI.

Philological Association.

October 20, 1899.—One hundred and seventy-sixth regular meeting. Professor Gildersleeve in the chair. Forty members were present.

Papers read:

Some Observations on the Latinity of Seneca. By M. C. SUTPHEN.
On the Sanskrit Original of the Pranon Oupnekhat in the Persian Translation of the Upanisads. By M. BLOOMFIELD.

November 17.—One hundred and seventy-seventh regular meeting. Professor Gildersleeve in the chair. Thirty-eight members were present.

Papers read:

The Text of Goethe's Faust. By H. WOOD.
The Scansion of Glyconic and Kindred Verse. By C. W. E. MILLER.

December 15.—One hundred and seventy-eighth regular meeting. Professor Gildersleeve in the chair. Thirty-three members were present.

Papers read:

On the Treatment of Classical Stories—Chiefly Ovidian—in Certain Elizabethan Narrative Poems. By G. D. BROWN.

The Recently-Discovered Inscription of the Roman Forum. By H. L. WILSON.

January 19, 1900.—One hundred and seventy-ninth regular meeting. Professor Gildersleeve in the chair. Thirty-five members were present.

Papers read:

On the Use of the Deus ex Machina, especially by Euripides. By H. B. FOSTER.

On a Passage in the Great Inscription of Beni Hassan. By C. JOHNSTON.

February 16.—One hundred and eightieth regular meeting. Professor Gildersleeve in the chair. Forty-two members were present.

Papers read:

The Origin of Mosaic Ritual. By P. HAUPT.
The Relation of Egyptian and Semitic. By C. JOHNSTON.
The Double Accentuation of the Decalogue. By K. J. GRIMM.
The Opening Chapter of Deutero-Isaiah. By F. R. BLAKE.
The Biblical Ephod. By T. C. FOOTE.
A Modern Cuneiform Congratulatory Message. By W. B. MCPHERSON.

Historical and Political Science Association.

October 6.—Vacation Experiences.

October 20.

Municipal History of Cleveland, Ohio. By C. SNAVELY.

Recent Literature on Africa. By W. S. DREWRY.

England and the Transvaal in International Law. By J. G. WHITELEY.

November 3.

The International Congress of Diplomatic History. By J. G. WHITELEY.

The Archives of the United States. By J. M. CALLAHAN.

England and the Transvaal. A review of recent literature and recent events. By W. S. MYERS.

November 17.

The Social Condition of the Southern Slave. By J. C. BALLAGH.

The Disestablishment of the Church of England. By J. C. AYER.

Review of Articles on the "Anglican Church Crisis." By B. KILBY.

Smart's "Theory of Distribution." By G. CATOR.

Eaton's "Government of Municipalities." By E. C. JOHNSON.

December 8, 1899.—The Millennial Anniversary of Alfred the Great. By J. M. VINCENT.

December 15.

Recent Banking Legislation in Germany. By S. SHERWOOD.

Financial Provisions of the "Overstreet Bill." By J. H. HOLLANDER.

The Banking Provisions of the "Overstreet Bill." By G. E. BARNETT.

January 5, 1900.

Report on the meeting of the American Economic Association. By S. SHERWOOD.

Report on the meeting of the American Historical Association. By J. M. VINCENT.

January 19.

The Trust Conference in Chicago, September, 1899. By GEORGE R. GAITHER, JR.

The Economists and the Trusts. By G. CATOR.

The Trusts from the Standpoint of the Bar. By I. A. THORSON.

Labor and Trusts. By V. E. SMITH.

The Trust and the Farmer. By W. E. MARTIN.

Socialism and the Trusts. By B. KILBY.

February 3.—The Peace Conference at the Hague. By F. W. HOLLS.

February 16.—The Economic Interpretation of History. By SIMON N. PATTEN.

Recent Literature on Africa. By W. S. MYERS.

Reinsch, English Common Law in the American Colonies. By R. J. MULFORD.

Maitland's Roman Canon Law in the English Church. By J. C. AYER.

Woodward's Expansion of the British Empire. By G. L. RADCLIFFE.

Cloete, The Great Boer Trek. By J. W. HARRY.

THE HIGHEST AIM OF THE PHYSICIST.

AN ADDRESS BEFORE THE PHYSICAL SOCIETY OF AMERICA BY ITS PRESIDENT, PROFESSOR HENRY A. ROWLAND.¹

Gentlemen and Fellow Physicists of America: We meet to-day on an occasion which marks an epoch in the history of physics in America; may the future show that it also marks an epoch in the history of the science which this Society is organized to cultivate! For we meet here in the interest of a science which above all sciences deals with the foundation of the Universe, with the constitution of matter from which everything in the Universe is made and with the ether of space by which alone the various portions of matter forming the Universe affect each other even at such distances as we may never expect to traverse, whatever the progress of our science in the future.

We, who have devoted our lives to the solution of problems connected with physics, now meet together to help each other and to forward the interests of the subject which we love. A subject which appeals most strongly to the better instincts of our nature and the problems of which tax our minds to the limit of their capacity and suggest the grandest and noblest ideas of which they are capable.

In a country where the doctrine of the equal rights of man has been distorted to mean the equality of man in other respects, we form a small and unique body of men, a new variety of the human race as one of our greatest scientists calls it, whose views of what constitutes the greatest achievement in life are very different from those around us. In this respect we form an aristocracy, not of wealth, not of pedigree, but of intellect and of ideals, holding him in the highest respect who adds the most to our knowledge or who strives after it as the highest good.

Thus we meet together for mutual sympathy and the interchange of knowledge, and may we do so ever with appreciation of the benefits to ourselves and possibly to our science. Above all, let us cultivate the idea of the dignity of our pursuit so that this feeling may sustain us in the midst of a world which gives its highest praise, not to the investigation in the pure ethereal physics which our Society is formed to cultivate, but to the one who uses it for satisfying the physical rather than the intellectual needs of mankind. He who makes two blades of grass grow where one grew before is the benefactor of mankind; but he who obscurely worked to find the laws of such growth is the intellectual superior as well as the greater benefactor of the two.

How stands our country, then, in this respect? My answer must still be, now, as it was fifteen years ago, that much of the intellect of the country is still wasted in the pursuit of so-called practical science which ministers to our physical needs and but little thought and money are given to the grander portion of the subject which appeals to our intellect alone. But your presence here gives evidence that such a condition is not to last forever.

Even in the past we have a few names whom scientists throughout the world delight to honor. Franklin, who almost revolutionized the science of electricity by a few simple but profound experiments. Count Rumford, whose experiments almost demonstrated the nature of heat. Henry, who might have done much for the progress of physics had he published more fully the results of his investigations. Mayer, whose simple and ingenious experiments have been a source of pleasure and profit to many. This is the meager list of those whom death allows me to speak of and who have earned mention here by doing something for the progress of our science. And yet the record has been searched for more than a hundred years. How different had I started to record those who have made useful and beneficial inventions!

But I know, when I look in the faces of those before me, where the eager intellect and high purpose sit enthroned on bodies possessing the vigor and strength of youth, that the writer of a hundred years hence can no longer throw such a reproach upon our country. Nor can we blame those who have gone before us. The progress of every science shows us the condition of its growth. Very few persons, if isolated in a semi-civilized land, have either the desire or the opportunity of pursuing the higher branches of science. Even if they should be able to do so, their influence on their

science depends upon what they publish and make known to the world. A hermit philosopher we can imagine might make many useful discoveries. Yet, if he keeps them to himself, he can never claim to have benefited the world in any degree. His unpublished results are his private gain, but the world is no better off until he has made them known in language strong enough to call attention to them and to convince the world of their truth. Thus, to encourage the growth of any science, the best thing we can do is to meet together in its interest, to discuss its problems, to criticize each other's work and, best of all, to provide means by which the better portion of it may be made known to the world. Furthermore, let us encourage discrimination in our thoughts and work. Let us recognize the eras when great thoughts have been introduced into our subject, and let us honor the great men who introduced and proved them correct. Let us forever reject such foolish ideas as the equality of mankind and carefully give the greater credit to the greater man. So, in choosing the subjects for our investigation, let us, if possible, work upon those subjects which will finally give us an advanced knowledge of some great subject. I am aware that we cannot always do this; our ideas will often flow in side channels; but, with the great problems of the universe before us we may sometime be able to do our share toward the greater end.

What is matter; what is gravitation; what is ether and the radiation through it; what is electricity and magnetism; how are these connected together and what is their relation to heat? These are the greater problems of the universe. But many infinitely smaller problems we must attack and solve before we can even guess at the solution of the greater ones.

In our attitude toward these greater problems how do we stand and what is the foundation of our knowledge?

Newton and the great array of astronomers who have succeeded him have proved that, within planetary distances, matter attracts all others with a force varying inversely as the square of the distance. But what sort of proof have we of this law? It is derived from astronomical observations on the planetary orbits. It agrees very well within these immense spaces; but where is the evidence that the law holds for smaller distances? We measure the lunar distance and the size of the earth and compare the force at that distance with the force of gravitation on the earth's surface. But to do this we must compare the matter in the earth with that in the sun. This we can only do by *assuming* the law to be proved. Again, in descending from the earth's gravitation to that of two small bodies, as in the Cavendish experiment, we *assume* the law to hold and deduce the mass of the earth in terms of our unit of mass. Hence, when we say that the mass of the earth is $5\frac{1}{2}$ times that of an equal volume of water, we *assume* the law of gravitation to be that of Newton. Thus, a proof of the law from planetary down to terrestrial distances is physically impossible.

Again, that portion of the law which says that gravitational attraction is proportional to the quantity of matter, which is the same as saying that the attraction of one body by another is not affected by the presence of a third, the feeble proof that we give by weighing bodies in a balance in different positions with respect to each other cannot be accepted on a larger scale. When we can tear the sun into two portions and prove that either of the two halves attracts half as much as the whole, then we shall have a proof worth mentioning.

Then as to the relation of gravitation and time, what can we say? Can we for a moment suppose that two bodies moving through space with great velocities have their gravitation unaltered? I think not. Neither can we accept Laplace's proof that the force of gravitation acts instantaneously through space, for we can readily imagine some compensating features unthought of by Laplace.

How little we know, then, of this law, which has been under observation for two hundred years!

Then as to matter itself, how have our views changed and how are they constantly changing. The round, hard atom of Newton, which God alone could break into pieces, has become a molecule composed of many atoms, and each of these smaller atoms has become so elastic that after

¹ Address delivered at the meeting in New York, October 28, 1899. Reprinted from the *American Journal of Science*, December, 1899.

vibrating 100,000 times its amplitude of vibration is scarcely diminished. It has become so complicated that it can vibrate with as many thousand notes. We cover the atom with patches of electricity here and there, and make of it a system compared with which the planetary system, nay, the universe itself, is simplicity. Nay, more: some of us even claim the power, which Newton attributed to God alone, of breaking the atom into smaller pieces whose size is left to the imagination. Where, then, is that person who ignorantly sneers at the study of matter as a material and gross study? Where, again, is that man with gifts so God-like and mind so elevated that he can attack and solve its problem?

To all matter we attribute two properties, gravitation and inertia. Without these two matter cannot exist. The greatest of the natural laws states that the power of gravitational attraction is proportional to the mass of the body. This law of Newton, almost neglected in the thoughts of physicists, undoubtedly has vast import of the very deepest meaning. Shall it mean that all matter is finally constructed of uniform and similar primordial atoms, or can we find some other explanation?

That the molecules of matter are not round, we know from the facts of crystallography and the action of matter in rotating the plane of polarization of light.

That portions of the molecules and even of the atoms are electrically charged, we know from electrolysis, the action of gases in a vacuum tube and from the Zeeman effect.

That some of them act like little magnets, we know from the magnetic action of iron, nickel and cobalt.

That they are elastic, the spectrum shows, and that the vibrating portion carries the electrified charge with it is shown by the Zeeman effect.

Here, then, we have made quite a start in our problem: but how far are we from the complete solution? How can we imagine the material of which ordinary or primordial atoms are made, dealing, as we do, only with aggregation of atoms alone? Forever beyond our sight, vibrating an almost infinite number of times in a second, moving hither and yon with restless energy at all temperatures beyond the absolute zero of temperature, it is certainly a wonderful feat of human reason and imagination that we know as much as we do at present. Encouraged by these results, let us not linger too long in their contemplation, but press forward to the new discoveries which await us in the future.

Then as to electricity, the subtle spirit of the amber, the demon who reached out his gluttonous arms to draw in the light bodies within his reach, the fluid which could run through metals with the greatest ease, but could be stopped by a frail piece of glass! Where is it now? Vanished, thrown on the waste heap of our discarded theories to be replaced by a far nobler and exalted one of action in the ether of space.

And so we are brought to consider that other great entity—the ether: filling all space without limit, we imagine the ether to be the only means by which two portions of matter distant from each other can have any mutual action. By its means we imagine every atom in the universe to be bound to every other atom by the force of gravitation and often by the force of magnetic and electric action, and we conceive that it alone conveys the vibratory motion of each atom or molecule out into space to be ever lost in endless radiation, passing out into infinite space or absorbed by some other atoms which happen to be in its path. By it all electromagnetic energy is conveyed from the feeble attraction of the rubbed amber through the many thousand horse-power conveyed by the electric wires from Niagara to the mighty rush of energy always flowing from the sun in a flood of radiation. Actions feeble and actions mighty from intermolecular distances through interplanetary and interstellar distances until we reach the mighty distances which bound the Universe—all have their being in this wondrous ether.

And yet, however wonderful it may be, its laws are far more simple than those of matter. Every wave in it, whatever its length or intensity, proceeds onwards in it according to well known laws, all with the same speed, unaltered in direction from its source in electrified matter, to the confines of the Universe unimpaired in energy unless it is disturbed by the presence of matter. However the waves may cross each other, each proceeds by itself without interference with the others.

So with regard to gravitation, we have no evidence that the presence of a third body affects the mutual attraction of two other bodies, or that the presence of a third quantity of electricity affects the mutual attraction of two other quantities. The same for magnetism.

For this reason the laws of gravitation and of electric and magnetic action including radiation are the simplest of all laws when we confine them to a so-called vacuum, but become more and more complicated when we treat of them in space containing matter.

Subject the ether to immense electrostatic, magnetic or gravitational forces and we find absolutely no signs of its breaking down or even of change of properties. Set it into vibration by means of an intensely hot body like that of the sun and it conveys many thousand horse-power for each square foot of surface as quietly and with apparently unchanged laws as if it were conveying the energy of a tallow dip.

Again, subject a millimeter of ether to the stress of many thousand, nay even a million, volts and yet we see no signs of breaking down.

Hence the properties of the ether are of ideal simplicity and lead to the simplest of natural laws. All forces which act at a distance, always obey the law of the inverse square of the distance, and we have also the attraction of any number of parts placed near each other equal to the arithmetical sum of the attractions when those parts are separated. So also the simple law of etherial waves which has been mentioned above.

At the present time, through the labors of Maxwell supplemented by those of Hertz and others, we have arrived at the great generalization that all wave disturbances in the ether are electromagnetic in their nature. We know of little or no etherial disturbance which can be set up by the motion of matter alone: the matter must be electrified in order to have sufficient hold on the ether to communicate its motion to the ether. The Zeeman effect even shows this to be the case where molecules are concerned and when the period of vibration is immensely great. Indeed the experiment on the magnetic action of electric convection shows the same thing. By electrifying a disc in motion it appears as if the disc holds fast to the ether and drags it with it, thus setting up the peculiar etherial motion known as magnetism.

Have we not another case of a similar nature when a huge gravitational mass like that of the earth revolves on its axis? Has not matter a feeble hold on the ether sufficient to produce the earth's magnetism?

But the experiment of Lodge to detect such an action apparently showed that it must be very feeble. Might not his experiment have succeeded had he used an electrified revolving disc?

To detect something dependent on the relative motion of the ether and matter has been and is the great desire of physicists. But we always find that, with one possible exception, there is always some compensating feature which renders our efforts useless. This one experiment is the aberration of light, but even here Stokes has shown that it may be explained in either of two ways: first, that the earth moves through the ether of space without disturbing it, and second, if it carries the ether with it by a kind of motion called irrotational. Even here, however, the amount of action probably depends upon relative motion of the luminous source to the recipient telescope.

So the principle of Döpler depends also on this relative motion and is independent of the ether.

The result of the experiments of Foucault on the passage of light through moving water can no longer be interpreted as due to the partial movement of the ether with the moving water, an inference due to imperfect theory alone. The experiment of Lodge, who attempted to set the ether in motion by a rapidly rotating disc, showed no such result.

The experiment of Michelson to detect the etherial wind, although carried to the extreme of accuracy, also failed to detect any relative motion of the matter and the ether.

But matter with an electrical charge holds fast to the ether and moves in the manner required for magnetic action.

When electrified bodies move together through space or with reference to each other we can only follow their mutual actions through very slow and uniform velocities. When they move with velocities comparable with that of light, equal to it or even beyond it, we calculate their mutual actions or action on the ether only by the light of our imagination unguided by experiment. The conclusions of J. J. Thomson, Heaviside and Hertz are all results of the imagination and they all rest upon assumptions more or less reasonable but always assumptions. A mathematical investigation always obeys the law of the conservation of knowledge: we never get out more from it than we put in. The knowledge may be changed in form, it may be clearer and more exactly stated, but the total amount of the knowledge of nature given out by the investigation is the same as

we started with. Hence we can never predict the result in the case of velocities beyond our reach, and such calculations as the velocity of the cathode rays from their electromagnetic action has a great element of uncertainty which we should do well to remember.

Indeed, when it comes to exact knowledge, the limits are far more circumscribed.

How is it, then, that we hear physicists and others constantly stating what will happen beyond these limits? Take velocities, for instance, such as that of a material body moving with the velocity of light. There is no known process by which such a velocity can be obtained even though the body fell from an infinite distance upon the largest aggregation of matter in the Universe. If we electrify it, as in the cathode rays, its properties are so changed that the matter properties are completely masked by the electromagnetic.

It is a common error which young physicists are apt to fall into to obtain a law, a curve or a mathematical expression for given experimental limits and then to apply it to points outside those limits. This is sometimes called extrapolation. Such a process, unless carefully guarded, ceases to be a reasoning process and becomes one of pure imagination specially liable to error when the distance is too great.

But it is not my purpose to enter into detail. What I have given suffices to show how little we know of the profounder questions involved in our subject.

It is a curious fact that, having minds tending to the infinite, with imaginations unlimited by time and space, the limits of our exact knowledge are very small indeed. In time we are limited by a few hundred or possibly thousand years: indeed the limit in our science is far less than the smaller of these periods. In space we have exact knowledge limited to portions of our earth's surface and a mile or so below the surface, together with what little we can learn from looking through powerful telescopes into the space beyond. In temperature our knowledge extends from near the absolute zero to that of the sun, but exact knowledge is far more limited. In pressures we go from the Crookes vacuum still containing myriads of flying atoms to pressures limited by the strength of steel but still very minute compared with the pressures at the center of the earth and sun, where the hardest steel would flow like the most limpid water. In velocities we are limited to a few miles per second. In forces to possibly 100 tons to the square inch. In mechanical rotations to a few hundred times per second.

All the facts which we have considered, the liability to error in whatever direction we go, the infirmity of our minds in their reasoning power, the fallibility of witnesses and experimenters, lead the scientist to be specially sceptical with reference to any statement made to him or any so-called knowledge which may be brought to his attention. The facts and theories of our science are so much more certain than those of history, of the testimony of ordinary people on which the facts of ordinary history or of legal evidence rest, or of the value of medicines to which we trust when we are ill, indeed to the whole fabric of supposed truth by which an ordinary person guides his belief and the actions of his life, that it may seem ominous and strange if what I have said of the imperfections of the knowledge of physics is correct. How shall we regulate our minds with respect to it: there is only one way that I know of and that is to avoid the discontinuity of the ordinary, indeed the so-called cultivated legal mind. There is no such thing as absolute truth and absolute falsehood. The scientific mind should never recognize the perfect truth or the perfect falsehood of any supposed theory or observation. It should carefully weigh the chances of truth and error and grade each in its proper position along the line joining absolute truth and absolute error.

The ordinary crude mind has only two compartments, one for truth and one for error; indeed the contents of the two compartments are sadly mixed in most cases: the ideal scientific mind, however, has an infinite number. Each theory or law is in its proper compartment indicating the probability of its truth. As a new fact arrives the scientist changes it from one compartment to another so as, if possible, to always keep it in its proper relation to truth and error. Thus the fluid nature of electricity was once in a compartment near the truth. Faraday's and Maxwell's researches have now caused us to move it to a compartment nearly up to that of absolute error.

So the law of gravitation within planetary distances is far toward absolute truth, but may still need amending before it is advanced farther in that direction.

The ideal scientific mind, therefore, must always be held in a state of balance which the slightest new evidence may change in one direction or another. It is in a constant state of scepticism, knowing full well that nothing is certain. It is above all an agnostic with respect to all facts and theories of science as well as to all other so-called beliefs and theories.

Yet it would be folly to reason from this that we need not guide our life according to the approach to knowledge that we possess. Nature is inexorable; it punishes the child who unknowingly steps off a precipice quite as severely as the grown scientist who steps over, with full knowledge of all the laws of falling bodies and the chances of their being correct. Both fall to the bottom and in their fall obey the gravitational laws of inorganic matter, slightly modified by the muscular contortions of the falling object but not in any degree changed by the previous belief of the person. Natural laws there probably are, rigid and unchanging ones at that. Understand them and they are beneficent: we can use them for our purposes and make them the slaves of our desires. Misunderstand them and they are monsters who may grind us to powder or crush us in the dust. Nothing is asked of us as to our belief: they act unswervingly and we must understand them or suffer the consequences. Our only course, then, is to act according to the chances of our knowing the right laws. If we act correctly, right; if we act incorrectly, we suffer. If we are ignorant, we die. What greater fool, then, than he who states that belief is of no consequence provided it is sincere?

An only child, a beloved wife, lies on a bed of illness. The physician says that the disease is mortal; a minute plant called a microbe has obtained entrance into the body and is growing at the expense of its tissues, forming deadly poisons in the blood or destroying some vital organ. The physician looks on without being able to do anything. Daily he comes and notes the failing strength of his patient and daily the patient goes downward until he rests in his grave. But why has the physician allowed this? Can we doubt that there is a remedy which shall kill the microbe or neutralize its poison? Why, then, has he not used it? He is employed to cure but has failed. His bill we cheerfully pay because he has done his best and given a chance of cure. The answer is *ignorance*. The remedy is yet unknown. The physician is waiting for others to discover it or perhaps is experimenting in a crude and unscientific manner to find it. Is not the inference correct, then, that the world has been paying the wrong class of men? Would not this ignorance have been dispelled had the proper money been used in the past to dispel it? Such deaths some people consider an act of God. What blasphemy to attribute to God that which is due to our own and our ancestors' selfishness in not founding institutions for medical research in sufficient number and with sufficient means to discover the truth. Such deaths are murder. Thus the present generation suffers for the sins of the past and we die because our ancestors dissipated their wealth in armies and navies, in the foolish pomp and circumstance of society, and neglected to provide us with a knowledge of natural laws. In this sense they were the murderers and robbers of future generations of unborn millions and have made the world a charnel house and place of mourning where peace and happiness might have been. Only their ignorance of what they were doing can be their excuse, but this excuse puts them in the class of bores and savages who act according to selfish desire and not to reason and to the calls of duty. Let the present generation take warning that this reproach be not cast on it, for it cannot plead ignorance in this respect.

This illustration from the department of medicine I have given because it appeals to all. But all the sciences are linked together and must advance in concert. The human body is a chemical and physical problem, and these sciences must advance before we can conquer disease.

But the true lover of physics needs no such spur to his actions. The cure of disease is a very important object and nothing can be nobler than a life devoted to its cure.

The aims of the physicist, however, are in part purely intellectual; he strives to understand the Universe on account of the intellectual pleasure derived from the pursuit, but he is upheld in it by the knowledge that the study of nature's secrets is the ordained method by which the greatest good and happiness shall finally come to the human race.

Where, then, are the greatest laboratories of research in this city, in this country, nay, in the world? We see a few miserable structures here and there occupied by a few starving professors who are nobly striving to do the best with the feeble means at their disposal. But where in the world

is the institute of pure research in any department of science with an income of \$100,000,000 per year. Where can the discoverer in pure science earn more than the wages of a day laborer or cook? But \$100,000,000 per year is but the price of an army or a navy designed to kill other people. Just think of it, that one per cent. of this sum seems to most people too great to save our children and descendants from misery and even death!

But the twentieth century is near—may we not hope for better things before its end? May we not hope to influence the public in this direction?

Let us go forward, then, with confidence in the dignity of our pursuit. Let us hold our heads high with a pure conscience while we seek the truth, and may the American Physical Society do its share now and in generations yet to come in trying to unravel the great problem of the constitution and laws of the Universe.

PERCY TURNBULL MEMORIAL LECTURESHIP.

EIGHTH COURSE OF LECTURES.

A lectureship to treat of Poetry has been instituted in this University by the generosity of Mr. and Mrs. Lawrence Turnbull, of Baltimore, who thus commemorate the name of their son, Percy Graeme Turnbull, who died in 1887.

In accordance with the terms of the gift, a course of lectures may be expected annually from some one who has gained distinction as a writer of poetry or as a critical student of the poetic art.

The Trustees have the pleasure of announcing that the eighth course of lectures on this foundation will be given by C. H. HERFORD, Litt. D., Professor of the English Language and Literature in the University College of Wales, and author of "Studies in the Literary Relations of England and Germany in the Sixteenth Century" (1886); a translation of Ibsen's Brand, in the original metres, with introduction and notes (1893); "The Age of Wordsworth" (1897). He is also General Editor of the "Warwick Shakespeare," and of the "Warwick Library." He has recently completed the "Eversley Edition of the Works of Shakespeare," in ten volumes (Macmillan Company).

The subject of the course will be *English Poetry, viewed and interpreted in its principal periods.*

The lectures will be given in McCoy Hall, at 5 o'clock, beginning Monday, April 23, 1900.

The lectures will begin punctually and will close within the hour. The door will be closed after the lecture begins.

TOPICS.

NATURE AND ROMANCE IN ENGLISH POETRY.

April 23.—The Germanic Core of English Poets.

April 24.—The Age of Chaucer.

April 26.—The Renaissance.

April 27.—The Elizabethans.

April 30.—The Seventeenth Century.

May 1.—The Return to Nature and the Revival of Romance.

I. From Pope to Blake.

May 3.—II. From Wordsworth to Tennyson.

May 4.—The Permanent Power of English Poetry.

PREVIOUS LECTURERS.

1891. EDMUND C. STEDMAN, LL. D., of New York,—"The Nature and Elements of Poetry."

1892. Professor RICHARD C. JEBB, LL. D., D. C. L., of the University of Cambridge,—"The Growth and Influence of Classical Greek Poetry."

1893. Professor ROBERT Y. TYRRELL, LL. D., Litt. D., of Trinity College, Dublin,—"The Growth and Influence of Latin Poetry."

1894. Professor CHARLES ELIOT NORTON, LL. D., D. C. L., of Harvard University,—"Dante."

1896. Professor GEORGE ADAM SMITH, D. D., of the Free Church College, Glasgow,—"Hebrew Poetry."

1897. M. FERDINAND BRUNETIÈRE, Editor of the "Revue des Deux Mondes,"—"French Poetry."

1898. Professor CHARLES R. LANMAN, Ph. D., of Harvard University,—"The Poetry of India."

CURRENT NOTES.

GEORGE HUNTINGTON WILLIAMS MEMORIAL LECTURES IN GEOLOGY.

Professor W. C. BRÖGGER, of the University of Christiania, the distinguished Norwegian geologist, has accepted an invitation to deliver the second course of the George Huntington Williams memorial lectures at the Johns Hopkins University, in April, 1900.

Professor Brögger is the most prominent Scandinavian geologist, and has published a series of memoirs upon the geology of Southern Norway that have given him rank among the leading investigators of his time. Professor Brögger comes as the successor in the Williams course to Sir Archibald Geikie, the Director-General of the Geological Surveys of Great Britain and Ireland, who opened the lectureship two years ago with a course upon The Founders of Geology. Professor Brögger will lecture upon Modern Deductions regarding the Origin of Igneous Rocks, a subject that has been commanding the attention of geologists in recent years.

LECTURES ON THE FOUNDERS OF THE REPUBLIC.

Professor JAMES SCHOULER, LL. D., of Boston, author of a "History of the United States under the Constitution," will deliver a course of biographical lectures on four of the great founders of the American Republic.

The lectures will be given Wednesdays and Fridays in the Donovan Room, McCoy Hall, at 5 p. m., and will be open to the public. The dates and special topics will be as follows: *March 7.*—Benjamin Franklin. *March 9.*—George Washington. *March 14.*—Alexander Hamilton. *March 16.*—Thomas Jefferson.

DONOVAN LECTURES, 1900.

Professor C. T. WINCHESTER, of Wesleyan University, Conn., will give a course of six lectures, on the Donovan foundation, his general subject being the *Essayists and Reviewers of the Beginning of the Nineteenth Century.* The course will begin on Wednesday, March 28, and will continue till Friday, April 6. The special topics will be: Introductory—The Reviews; Hazlitt; Lamb; Wilson; DeQuincey; Leigh Hunt.

Dr. G. STANLEY HALL, President of Clark University, gave ten lectures on Psychology and Education, in McCoy Hall, February 5-16.

ALBERT H. SMYTH, Professor of English in the Central High School of Philadelphia, gave a course of eighteen lectures on Modern English Literature, December 15 to February 17. The lectures were in three groups,—first, six lectures on Living English Writers; second, six lectures on the Lake Poets; third, six lectures on Burns and Scott.

Dr. FREDERICK M. WARREN, Professor of Romance Languages in Adelbert College, gave eight lectures on the Modern French Drama, January 23 to February 7.

FREDERICK W. HOLLS, of New York, Secretary and Counsel to the American Commissioners to the Peace Conference at the Hague in 1899, delivered two lectures on the work of the Conference, in McCoy Hall; the first (open to the public) on February 2, and the second (designed for students of historical and political science and of law) on February 3.

The Reverend Canon H. D. RAWNSLEY, of Keswick, England, who is a promoter of the society lately formed in England to preserve the shrines of literary and historical associations, addressed the students of the Johns Hopkins University on October 25.

In the Public Educational Course, of which a detailed announcement was given in the last *Circular*, courses by Dr. Shattuck and Dr. Fassig, in Geology and Meteorology; by Professor Ames, in Physics; by Dr. Jeffrey R. Brackett and Dr. J. H. Hollander, in Studies of the Modern City, have been in progress. The lectures of Professor Smyth, above noted, formed a part of this course. Single lectures were also given by Dr. James E. Russell, Dean of the Teachers College, New York, and by Dr. James McAlister, President of the Drexel Institute, Philadelphia.

NOTES IN PHILOLOGY.

On the Treatment of Classical Stories—Chiefly Ovidian—in Certain Elizabethan Narrative Poems.
By GEORGE DOBBIN BROWN.

[Abstract of a paper read before the University Philological Association, December 15, 1899.]

The poems considered were: Lodge's *Glaucus and Scylla*; Shakspeare's *Venus and Adonis*; Shakspeare's *Lucrece*; Marston's *Pigmalion's Image*; Gresham's *Picture of Incest*; Barksted's *Myrrha*, the mother of *Adonis*; Austin's *Scourge of Venus*; Marlowe's *Hero and Leander*; Chapman's continuation of Marlowe's *Hero and Leander*; Beaumont's *Salmacis and Hermaphroditus*.

Ovid, being at once the greatest story-teller of Rome, and the most fanciful, rhetorical, and Italian of Latin poets, was from these two characteristics especially dear to the Elizabethan heart, and influenced the poets of the day more than any other classical writer. Numberless passing references to classical stories prove their indebtedness to Ovid; but it is certain poems that come as a whole from his works which we are here particularly interested in.

Upon examination we find the Elizabethans' methods of using Ovidian stories to be extremely diverse, the only characteristic common to all the methods being freedom of treatment. Attempting to classify, we may say that this freedom of treatment may, on the one hand, consist in the expansion of elements already present in the source; or, on the other hand, it may be due to the addition of new features, and these new features may be either invented by the poet, or borrowed from some secondary source. Thus as methods of treatment we have Expansion, Original Addition, and Contamination, more than one of which are frequently followed in the same poem. As we might expect from the luxuriant nature of the Elizabethan period, the negative methods of Omission and Compression are far less prominent.

Ovid's story of *Scylla's* disdain for *Glaucus* is told with the greatest freedom of addition (and of thereby necessitated omission) by Lodge, who, with the evident desire of balancing off episode against episode, completes the poem with thorough-going original additions descriptive of the cured *Glaucus's* disdain of the wounded *Scylla*.

In Shakspeare's *Venus and Adonis* we have a contamination of Ovid's stories of *Venus* and *Adonis* and of *Salmacis* and *Hermaphroditus*. Shakspeare takes incidents from both tales and the inner spirit of the second (after which, however, he does not name his poem), and with great artistic success blends and expands them into an effectually new form.

In his *Lucrece* Shakspeare borrows from both of the slightly different forms of the story as given by Livy and Ovid. The distinguishing characteristic of Shakspeare's treatment is, however, expansion. In addition to the Virgilian elements in the *Picture of Troy* usually pointed out, attention must be called to a fact not noticed by the commentators,—that the scene which paints the Greeks and Trojans preparing for battle could have come only from Homer.

Marston in his *Pigmalion's Image* is chiefly concerned with the enlargement and excessive emphasis of sensual details, thus giving to Ovid's chaste enough story a very licentious turn.

Gresham's *Picture of Incest* amounts to little more than a metrical translation of Ovid's *Cinyras* and *Myrrha* story with the slight addition of short similes and proverbial sayings.

Barksted makes two important additions to Ovid's *Cinyras* and *Myrrha* story. I. He explains how *Myrrha* became inflamed with her criminal love. II. He gives an account of what happens during *Myrrha's* wandering in *Panchaea*. Both of the episodes have numerous reminiscences of Ovid, the second being indeed an Ovidian mosaic.

Austin, treating the same story, makes perhaps the most artistic contamination we have seen since Shakspeare's *Venus and Adonis*, though of far more mechanical a nature. This contamination has been pointed out by Dr. Kirby Smith, and consists in the introduction of the dream and the letter from Ovid's *Byblis* story.

Marlowe's treatment of *Musaeus's* *Hero and Leander* consists, in part, of very beautiful expansions. But far less satisfactory is the introduction

at the end of the first sestiad of some original mythologizing, conceived along Ovidian lines. This interpolation, though in itself fairly well told, is out of place and interrupts the flow of the main story.

Equally ill-timed and less well composed interpolations, which their authors doubtless considered to be written in true Ovidian style, ruin Chapman's continuation of Marlowe, and seriously mar Beaumont's telling of Ovid's *Salmacis* and *Hermaphroditus* story.

An Ovidian passage which I believe has not before been pointed out as a source for Shakspeare (though not in his narrative poetry) may be seen in *Metam.* xv. ll. 176–185 and ll. 214–236, which certainly gave rise to sonnet 60. If Shakspeare knew these lines, he almost certainly knew the passages immediately preceding and following, and I would therefore suggest a connection between *Metam.* xv. ll. 153–175 and sonnet 59, and *Metam.* xv. ll. 239–258 and sonnets 44 and 45.

On the Use of the Deus ex Machina, especially by Euripides. By H. B. FOSTER.

[Abstract of a paper read before the University Philological Association, January 19, 1900.]

The speaker took up first the well-worn ideas on the subject of Euripidean employment of machinery at the end of many dramas,—Schlegel's too scathing denunciation, Jacobs and Welcker in their more moderate statements,—and then passed on to the histories of Greek literature. Otfried Müller regards the device as showing that dramatic action had lost the power of natural development. Bernhardt rather believes in the theory of a knot. Bender mentions false economy in general. Jevons and Mahaffy think the action was cut off at both ends to allow the poet greater freedom in the body of the play. Sittl sees caprice on the part of gods, and a convenient tragic tool. Perry feels the appearance of divine beings to be necessary in the age of Euripides, if they were to receive any recognition of authority. Christ says the *deus* usually screens haste or lack of talent.

After this attention was called to Schrader's essay (limited to the subject in hand) in which he renders the special service of proving that only in the *Orestes* do matters come to such a pass that the situation is inextricable without divine intervention. His attempt to reconcile Euripides with Aristotle and Horace is not, however, so successful. A few minutes were devoted to Weil (who follows Schrader), and to the treatises of Kühlenbeck and of Widemann (both from the scenic standpoint) and of Dühr, who tries to prove epic influence.

The speaker disagreed with Verrall's conclusion, that every god is a grotesque insincerity, and showed by an example or two how entirely usual is the general function of the divinities, and how the characters impute to them no extraordinary qualities. The ancient references to *deus ex machina* were next set forth,—Plato (Cratylus and Cleitophon), Antiphanes, Menander, Lucian, Demosthenes, Suidas, all of them, whether they spoke disparagingly or not, much later than Euripides.

Euripides was an artist. He found the *deus ex machina* already existing in the poems of Homer. The idea was a commonplace among ancient peoples; there are instances in the Old and New Testament, in the Sanskrit drama, and elsewhere. Euripides merely transferred it to the stage, showing everywhere, save in the *Orestes*, an evident predilection for it. To a believing audience the method is not essentially undramatic.

What the poet thought of the gods does not plainly appear from his writings. In every case the element of characterization must be deducted. Hence from many utterances, for and against, we can gather of personal feeling only a general notion of vast external forces, called now Zeus, now Fate, now Aether, which are pressing down upon dependent man. One who examines the speeches of the *dei ex machina* themselves finds in almost every one a manifestation of this irrevocable destiny. Such phrases as *πεπωρωμένον γὰρ ἔστιν, ἔστι νόστιμον, μοῖρα Ζεὺς τ' ἔκρανε* constantly occur. This sense of impending fate is everywhere an undercurrent of Greek life. It is the reason that the gods of Euripidean drama assign for their interference. The notion of fate is elsewhere in Euripides strong,—more strik-

ing than in Sophocles. The man himself, a moody recluse, had the temperament for it. Herein we see at all events an intelligible artistic motive for the god from the machine. He illustrates the futility of human endeavor.

The prophecies of the gods, subsequent to their appearance, were, the speaker proceeded, phenomena of a different category. They were apparently not the occasion of the divine advent, but rather an afterthought, introduced when the *deus* had completed the more practical part of his mission. The omniscient immortal lent himself to a convenient literary trick, by which, in a narrative relegated to some remote past, events are foretold which the hearers know to have been fulfilled. Virgil in his *Aeneid* (Book VI) employs this method to rehearse the glories of Rome, and modern poetry is by no means free from it.

The paper closed with a few general notes and a list of the situations in the various plays, to show the unexpected turn of affairs in each instance occasioned by the *deus ex machina*.

The Recently Discovered Inscription of the Roman Forum. By H. L. WILSON.

[Abstract of a paper read before the University Philological Association, December 15, 1899.]

The excavations carried on during the year 1899 in the Roman Forum, and particularly in the Comitium, have been of the highest importance. Most of all, the inscribed stele, which is roughly broken, apparently by the hand of man, at what is supposed to have been about the middle of its original height, has given rise to one of the most animated, not to say bitter, philological controversies of recent times, and continues even yet to excite the greatest interest. The first announcement of the discovery, together with photographic facsimiles and remarks by various scholars, appeared in *Notizie degli Scavi* for May, 1899. The text of the inscription, engraved in an archaic Greek alphabet, is a vertical *Βουστροφὴδόν*, the only example of the kind yet found on Italian soil. On this account the mutilation is alternately at the beginning and the end of the lines. Without considering Professor Ceci's wild assignment of the monument to the early regal period, we may regard it as certain that this is the oldest Latin record on stone, a record which in age is comparable only with the vase of Duenos and the *fibula Praenestina*.

To the grammarian the inscription is especially interesting in two points, namely, the words *sakros* and *iouzmenta*. It is well known that in *-ro* stems, the final *-ros*, when preceded by a consonant, was changed by a phonetic process common to Latin with other Italic languages to *-er*, e. g. *ager* = **agro-s* (*ἀγρός*), Umb. *ager*. Hitherto this phonetic change has been regarded as consummated in a proto-Italic period: in the new inscription, however, we have the form *sakros*, which now stands in all the grammars with the asterisk as a non-attested form. *Iouzmenta*, which Ceci divides into *iouz. menta* and explains by the aid of Umbrian *iuka* (*preces*), is nevertheless to be regarded as an equivalent of *iumenta*: whether as the earlier form which phonetically yielded *iumenta*, or as a secondary, analogical formation, or as a graver's error, is not easily decided. If the first, then support is given to the theory that in combinations of guttural + s + m (n), the guttural and s disappear. *Iouzmenta* is of course the same as *iougsmenta*, but *ioug(e)s-menta*, suggested in explanation by Ceci, is a philological monstrosity not to be considered for a moment.

The most sensible attempt at restoration and interpretation of the inscription is that offered without much confidence by Professor Comparetti in *Atene e Roma*, 1899, No. 10, 145-161. He regards the stele as a kind of signpost, with more than one inscription, intended to ward off trespassers and preserve the sacred enclosure from desecration. The probable date of the monument—about 400 B. C.—was reached by Hülsen (*B. Ph. W.* 1899, Nos. 31, 32), and W. Otto (*Arch. Lat. Lex.*, xi, 436) independently, by the former on metrological, by the latter on linguistic grounds.

In spite of the labors of many scholars, we are still very far from comprehending this inscription, and it may be that, as in the case of the Duenos vase, no real consensus of opinion on the subject will ever be reached. If new light comes, it will probably come from the continued excavations in the Forum.

Note. Since the presentation of the paper which here appears in abstract, Giacomo Tropea has published in the *Rivista di storia antica*, iv, pp. 469-

509, an excellent account of the discovery and the discussion of the monument up to the end of 1899 under the title "*La Stele Arcaica del Foro Romano*."

The Scansion of Glyconic and Kindred Verse. By C. W. E. MILLER.

[Abstract of a paper read before the University Philological Association, November 17, 1899.]

The paper presented under the above title was essentially an adaptation of a review, since published in *A. J. P.*, xx. (1899), 331-3, of a recent treatise on Greek Rhythms and Metres. The author of this treatise had condemned the current mode of scansion of Glyconic and kindred verse and had proposed instead a radically different though not entirely new scansion. The proposed method was closely scrutinized and its difficulties and other objectionable features were pointed out, whereas the system now prevailing was defended as being essentially correct and in conformity with the laws of Greek rhythm enunciated on p. 125 of No. 32 (July, 1884) of these *Circulars*.

The Colloquial Element in Seneca. By M. C. SUTPHEN.

[Abstract of a paper read before the University Philological Association, October 20, 1899.]

To the student of his literary age Seneca may best be selected as the model for investigation. The criticism of his style and diction, the *cause célèbre* of antiquity, must be earnestly considered if we would know silver latinity.

Buecheler in a note in *Wochschr. Archiv* was the first to raise his voice against unnecessary emendation in this author, pointing out the fact that the colloquial element in Seneca's works had been too little regarded. An investigation conducted with some minuteness, especially on the lexical side, justifies this opinion. Seneca uses a number of diminutives with the colloquial loss of the diminutive feeling, frequent instances occur of verbs unnecessarily compounded with *ad*, *con*, *de* and especially *ex*, and substitutions, such as *civitas* for *urbs*, *genus* for *modus*, *tam magnus* for *tantus*, are by no means uncommon. Especially noticeable is the great mass of proverbial and popular phraseology, by no means confined to the Apocolocyntosis, but appearing throughout his writings. Much of his latinity finds excellent parallels in the church fathers.

The *sermo cotidianus* is of course natural to comedy and is properly employed by Petronius in the speech of the parvenu Trimalchio¹. But it may well be asked, why does so decided an element manifest itself in Seneca, a Stoic philosopher?

Teuffel, in his *Studien*, remarks that Persius secure in his social position, used colloquialisms with much greater freedom than Horace, the son of a *libertinus*. The emperor Augustus, according to the statement of Suetonius, did not affect the purity of diction exhibited by Julius Caesar. Seneca was similarly unrestricted in his choice of expression.

Again, by taking into consideration the Stoics, both Latin and Greek, we may fairly assume that strictness in style and language was not urged in this philosophic school. Diminutives are rampant, for the Stoic looking down from the lofty pinnacle of his virtue, held all mankind as poor little ants struggling in the sand-heap of an insignificant world. As practical philosophers—and sometimes politicians—they wanted their words to strike home. Take care of the words and the sense will take care of itself was their *dictum*. Such little things as the paltry restrictions of grammarian or purist could not bind the free unfettered soul of the Stoic.

A third element in the question we may style, the genius of his age. The study of silver latinity is no easy one,—the cross-currents of literary feelings and purposes may puzzle even the experienced navigator and much is still unnoted on the chart. It was the age of protest against former literary models and the broad smooth current of Cicero breaks up into the choppy waves of Seneca. Life, despite its artificiality, was the aim in manners and in literature. True to his age, Seneca found need of the *sermo cotidianus* equally with Horace in his laughing criticism, Persius and Juvenal in their invective or Martial in the biting epigram.

¹ The freedom of satire likewise encouraged its use in that department.

NOTES ON ZOOLOGICAL COLLECTING IN JAMAICA, W. I.

By FRANKLIN STORY CONANT, Ph. D.

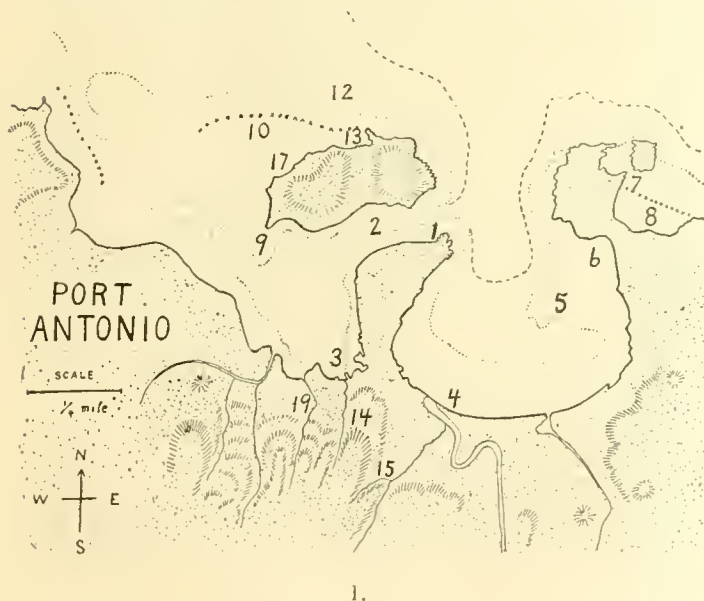
Edited by E. A. ANDREWS.

While the Marine laboratory of the Johns Hopkins University was stationed at Port Antonio, Jamaica, W. I., in the Summer of 1897, the late Dr. F. S. Conant made, incidentally to his researches, some observations upon the fauna of that region. Though these notes are necessarily meagre and imperfect it seems advisable to put them into print for the benefit of subsequent workers in that region, since experience has shown that any hint is welcome to one seeking material for research in a new locality.

In a limited way these notes also indicate the contrast in marine fauna between Port Antonio and Port Henderson, when compared with notes made at the latter station and published in these Circulars, Vol. XI, 1892, pp. 72-77.

Following Dr. Conant's notes we give: first, a list of the shore collecting at nineteen localities, most of which are indicated upon the accompanying sketch of the Port Antonio region; second, a recapitulation of the facts by lists of animals found with figures to designate their distribution, as far as recorded in the notes; and finally, some of Dr. Conant's records of surface and bottom collecting.

When not otherwise designated the animals were "common" at the localities where collected.



(1) The small reef off the end of Litchfield Point being most accessible to the Laboratory was most thoroughly investigated by wading at low tide, and furnished a good variety of forms.

Porifera, Black, white yellow, purple, green, red and brown sponges. *Coelenterata*, *Librunea neglecta*, comparatively common though extremely rare elsewhere. *Condylactis passiflora*, fairly common. Colour varieties of *Phymanthus crucifer*. *Discosoma anemone*, few. *Aiptasia annulata* and *Heteractis lucida*, numerous. An isolated form of *Gemmaria*? *Millepora*, very common. A *Stylaster*? with red skeleton. *Vermes*, comparatively few species of tubicolous *Polychaeta* and of *Turbellarians* and *Nemerteans*. Eggs in gelatinous masses like those of *Clymenella*. *Echinodermata*, *Cidaris tribuloides* *Diadema setosum*, very common. *Hippoonoe esculenta*, not very common. *Echinometra subangulans*. A small star-fish like *Oreaster*. *Synapta lappa*, now and then. *Chiridota rotifera*?, rare. *Holothuria* sp.?, not common. *Mülleria* sp.?, not common. Two species of *Spatangoids*. Five species of *Ophiurians* and another star-fish, of undetermined affinities. *Mollusca*, *Chiton*, very abundant. A *Fissurella*, now and then. *Nerita*? and *Oliva*? Small *prosobranchs*. An *Octopus*, rare. A small *cardium-like* *Lamellibranch*. *Aplysia* and two small *nudibranchs*. *Crustacea*, *Grapsus*, very common on shore rocks. Two other crabs. *Alpheus* sp.? *Gonodactylus*. A small red decapod with chelae on third pair of

periopods. *Stenopus hispidus*. A decapod with white cephalothorax and red-yellow abdomen. *Panularis americanus*, several specimens. *Tunicata*, A long red *Ascidia*?, rare.

(2) Floating in the channel between Navy Island and Titchfield, off the Laboratory were taken an *Aurelia-like* *Semostome* in abundance. Also *Charybdea xaymacana*, now and then. *Appendicularia* was also dipped up here.

(3) The Wharf of the Boston Fruit Company and its vicinity furnished *Scelopendra-like* centipedes and small millipedes, lizard eggs and snail eggs. There were also taken an *Aurelia*?, very abundant: marine *gasteropods* and *sabella-like* *polychaeta*.

(4) Along the beach of East Harbor, near West Town River *chitons* and a *lamellibranch* were common, as also a brown *Hippa*. *Gelasimus* occurred, but not common.

(5) In the shallow water on the East side of East Harbor were found: *Coelenterata*, a tubularian hydroid and *Aiptasia annulata*. *Porifera*, a brown sponge. *Vermes*, two tubicolous *Polychaeta*. *Echinodermata*, *Toxopneustes varieagatus*, *Cidaris tribuloides*? and, not common, *Mülleria*, *Synapta lappa*?, *Mellita sexforis*, *Pentaceros reticulatus* and an *Asteroid*. *Mollusca*, a *lamellibranch*. *Crustacea*, *Calappa marmorata*, quite often seen. *Tunicata*, a compound *ascidian*, not common.

(6) On the shallows of the North-East end of East Harbor were found: *Porifera*, purple, green, and brown sponges. *Coelenterata*, tubularian hydroids not common, *Aiptasia annulata*. *Vermes*, a nemertean, a turbellarian and two *polychaeta*. *Echinodermata*, a *spatangoid*, rare, *Synapta lappa*?, two *ophiurids*, not common, *Diadema setosum*, *Echinometra subangulans*, *Toxopneustes varieagatus*, not common, *Hippoonoe esculenta*, *Cidaris tribuloides* and two or three *clypeasteroids*. *Mollusca*, a *chiton*, *aplysia*, a *lamellibranch* and some *gasteropods*. *Tunicata*, a compound *ascidian*.

(7) The channel and shores between Folly Point and Wood Island proved good collecting grounds: *Porifera*, white and yellow sponges. *Coelenterata*, *Physalia*?, *Condylactis passiflora*, *Aiptasia annulata*, *Aulactinia styloides*, *Actinoides pallidi*, *Ricordea florida*, *Discosoma anemone*, *Palythoa* sp., *Zoanthus*, *Meandrina* sp., *Porites* sp., *Astrea*, several species, *Rhipidigorgia*, with commensal *opisthobranchs*, *Millipora*, *Aleyonaria* and a red *Stylasteroid*. *Vermes*, a *Sipunculoid* and two *Polychaeta*. *Echinodermata*, *Diadema setosum*, *Hippoonoe esculenta*, *Cidaris tribuloides*, not common, *Echinometra subangulans*, two *spatangoids*, not common, five *ophiurids*, *Synapta lappa*, *Chiridota rotifera*, *Holothuria* and an *asteroid*, not common. *Mollusca*, several species of *Chiton*, *Fissurella* sp.?, two *nudibranchs*, *Aplysia*, and an *octopus*, rare. *Crustacea*, *Grapsus* and several other crabs, *Hippa*, the white species, *Gonodactylus* sp.?, *Alpheus* sp.?, small red decapod with chelae on the third pair of periopods.

(8) The shore "awash," East of Folly Point is a sandy shore with large patches of *Posidonia* and other plants and the water is sometimes muddy. It yielded only: *Coelenterata*, *Discosoma anemone*, D. sp. n.?, *Aiptasia annulata*, rare, *Phellia* sp., *Bunodes granulatus*, *Asteractis* sp. n.?, rare, *Actinophorus elegans*, not common. *Echinodermata*, *Chiridota*, *Echinometra subangulans*, not common, an *Ophiurid*, *Hippoonoe esculenta*. *Vermes*, *Sabellaria*? and *sipunculoids*; *Mollusca*, *octopus*; *Pisces*, *Muraena* sp. and conger eel.

(9) The Sand Bank and shallows, Southwest of Navy Island: *Porifera*, purple, green and red sponges. *Coelenterata*, *Aiptasia annulata* and another sea anemone, *Condylactis passiflora*, a brownish yellow, horny hydroid, corals, *Discosoma* sp. n.?, *Echinodermata*, a black species of *Holothuria*?, *Mülleria*?, not common, *Synapta lappa*? not common, *Cidaris tribuloides*?, *Hippoonoe esculenta*, not common, *Ophiocoma aethiops*? a second species of *Holothuria*, *Brissus*. *Vermes*, a platode parasitic in *Holothuria*. *Mollusca*, *Aplysia*, not common, three species of conchs, *Pinna* and boat-shells. *Tunicata*, a *Botryllus*.

(10) Collected on the Coral Reef West of Navy Island: *Coelenterata*, abundant corals, *aleyonaria* not very common, *Stylaster*?, *Millepora*, an anemone and the jelly-fish, *Cassiopea*. *Echinodermata*, *Diadema setosum*, *Echinometra subangulans*, *Hippoonoe esculenta*, not common, *Cidaris tribuloides*, *Synapta lappa* and two forms of *Ophiurids*. *Crustacea*, a small *Alpheus*? in the rock, a *Libinia-like* crab, and rock boring barnacles. *Pisces*, small, bright-colored fish, more numerous and of more kinds than on the reefs off Kingston Harbor; one with pair of fins apparently transformed into creeping and attaching organs. *Vermes*, incrustations of shell-building *Annelids*, several *Sabella-like* and other *polychaeta*. *Mollusca*,

the common chiton and a smaller, "woolly" form, that is not common, a few fissurella and a pinna shell, one of the forms of conch and of octopus.

(11) "Blue Hole," a locality outside the limits of the accompanying sketch, proved a very favorable collecting region. *Porifera*, the yellow sponge. *Celenterata*, corals not very abundant. *Echinodermata*, *Diadema setosum*, *Cidaris tribuloides*, *Echinometra subangularis*, *Hipponoe esculenta*, *Synapta lappa*, and four species of *Ophiurians*. *Vermes*, several specimens of a sipunculoid and two polychaete. *Mollusca*, conchs, not common, chiton, small prosobranchs, a clam re-sembling venus, land snails and eggs of slugs, a small species of *Aplysia*. *Crustacea*, hermit crabs, very common, *Stenopus*, *hippidus*. *Tracheata*, *Phrynus*, *Centrurus insulans*, with young, *Peripatus*, one specimen on the hill. *Pisces*, "tobacco-fi-h."

(12) Surface collecting in the open, Northwest of Navy Island: *Oscillatoriaceae*, *Trichodesmium erythraeum*, very abundant. *Protozoa*, a compound Radiolarian. *Celenterata*, *Charybdea* sp.? several *Hydromedusae* sp.?, at least three kinds of Siphonophores, two forms of *Planula* larvæ, *Ephyrae*, one small anemone. *Vermes*, a few large *Tornaria*, four or five kinds of small Polychaete, *Sagitta flaccida*, very abundant, *S. tenuis* and *S. hispidus*, not common, *Trochophores*, not common, a few *Planarians*. *Mollusca*, *Heteropods* and *Pteropods*, shelled *Gastropod veliger*, not common. *Crustacea*, transparent *Isopod*?, *Phyllosome* larva of *Palinurus*, not common, *Copepods*, very large *Lucifer*, not common, small shrimp, *Erichthus* larvæ, *Zoea*, *Ostracods*, *Megalops*, not frequent, "woolly larva" (*zoëa*?) *Tunicata*, *Salpa* and *Doliolum*, not common. *Teleostei*, fish eggs, not common, small pipe fish, small ribbon-like transparent form, *Leptocephalus*.

(13) Along North shore of Navy Island the following *Echinodermata* were found: *Diadema setosum*, two *Spatangoid* forms, one not common, five species of *Ophiurid*, *Holothuria* sp.?, two *Asteroids*, *Chiridota rotifera*.

(14) In the Old Church Yard were taken: *Crustacea*, *Isopods*. *Tracheata*, scorpions, not common, three kinds of *Myriapods*, cockroaches. *Mollusca*, land snails and large yellow slugs, not common. *Vermes*, *Oligochaete*. *Reptilia*, lizards.

(15) Richmond Hill and fresh stream to the East: *Mollusca*, *Gastropods* and large yellow slugs, not common. *Crustacea*, shrimps and fresh-water crabs. *Tracheata*, large black and small *Chilognaths*, a large, rare beetle. *Amphibia*, small tree-frogs. *Reptilia*, lizard eggs.

(16) A ravine on the Bog Estate above the Reservoir; not shown on the map: *Vermes*, a dark blue *Oligochaete*. *Mollusca*, slugs and three kinds of land snails. *Crustacea*, hermit crabs. *Tracheata*, scorpions and pseudoscorpions, several kinds of myriapods, phrynus, spiders, several species of ants and of beetles. *Amphibia*, tree-frogs and large toad. *Reptilia*, a small snake with reddish belly.

(17) Along the West Shore of Navy Island: *Celenterata*, *Rhodactis Sancti Thomae*, *Ricordea florida*, with orange-tipped tentacles, *Discosoma anemone*, *Isaurus* sp. *Echinodermata*, *Clypeaster* sp. not common. *Vermes*, eggs in pear-shaped, pedunculated masses, a long, slender polychaetous annelid in mud. *Crustacea*, *Stenopus hispidus*, *libinia*-like crab, *Alpheus*?

(18) At Williamsfield (beyond the limits of the map) were found *Aiptasia annulata*?, numerous worm castings, a large black tectibranch, oysters and mussels on mangrove roots, and a blue-clawed crab like *Callinectes*.

(19) In the fresh brook back of the Boston Fruit Company's Wharf were found small and large shrimps, a grapsus-like crab and small fish. Near by were taken hermit crabs, *Phrynus*, one pseudoscorpion and six bunches of slug's eggs.

II.

The recorded distribution of the various forms mentioned is given below with numbers to indicate the above localities.

Protozoa: compound Radiolarian 12.

Porifera: purple, green and red sponges 1, 9; brown sponge 1, 5, 6; black sponge 1; white sponge 1, 7; yellow sponge 1, 7, 11. *Celenterata*: a tubularian hydroid 5, 6; *Condylactis passiflora* 9, 7; *Aiptasia annulata* 1, 5, 6, 7, 8, 9, 18; *Discosoma anemone* 1, 7, 8, 9, 10, 17; Siphonophores 12; *Aurelia*? 2, 3; *Charybdea* *Naymacana* 2, 12; *Anthomedusa* 12, 2; *Physalia* 7; *Aleyonaria* 7, 10; brownish-yellow, horny hydroid 9; *Cassiopea* 10; *Planula* 12, and *Ephyra* 12; *Lebrunea neglecta* and *Phymanthus crucifer* 1, 10; *Aiptasia lucida* 1, *A. lagites* 8; *Gemmularia* sp. 1; *Millepora alcornis* 1, 7, 10; *Stylaster*? 1, 7, 10; *Rhodactis Sancti Thomae* 10, 17; *Ricordea florida* 7, 10, 17; *Isaurus* 1, 17; *Phellia* 1, 8 and almost all shores; *Aulacina styloides* 7, 8; *Actinoides pallida* 7, 8 and almost all shores; *Palythoa*

7, 10; *Zoanthus* 7, 10; *Meandrina*, *Porites*, *Astraea*, *Rhipidigorgia*, 7; *Asteractis* sp. n.? 8 and common along shores; *Actinophorus elegans*, only one specimen seen 8; *Bunodes granulatus* 8; *Discosoma helianthus* 8, 9; *Lebrunea coralligius* 1, 10; *Bunodeopsis* sp. n. 9.

Echinodermata: *Synapta lappa*? 1, 5, 6, 7, 9, 10, 11; *S. sp.*? 1; *Mülleria*? 1, 5, 9; *Stichopus* 1; *Toxopneustes varieagatus* 5, 6; *Cidaris tribuloides*? 1, 5, 6, 7, 9, 10, 11; *Echinometra subangularis* 1, 6, 7, 8, 10, 11; *Diadema setosum* 1, 6, 7, 10, 11, 13; *Hipponoe esculenta* 1, 6, 7, 8, 9, 10, 11; *Holothuria*, two large forms 9, small purplish and yellowish brown 1, 7, white and yellow 7, greyish with some reddish 7, 17; *Asteroids*, small with roundish disk 1, 7, 17, a reddish form 1, 17, flat, small, dark green 5, arched, medium-sized green and brownish 1; *Ophiurids*, large with coarse spines, brick red 1, 6, 7, 10, *Ophiocoma aethiops* 1, 6, 7, 8, 9, 10, 13, small, black and white arms 1, 7, 13, medium-sized, no spines 1, 7, 13, medium-sized, spines, snaky arms 1, 7, 9, 13; *Echinoneus* 1, 6, 7, 13; *Chiridota* 1, 8, 7, 13; *Brissus* 9; small greyish-brown, third *Spatangoid* 1, 7, 13; *Clypeastroid* 13; *Clypeaster* 1, 17; *Mellita sexforis*? 5; *Pentaceros reticulatus* 5; *Linckia*, 1, 13.

Vermes: *Planarian* 12; *Turbellarian* 1, 6; flat worm parasitic in *Holothuria* 9; *Tornaria* and large hat-shaped *tornaria* 12; *Nemerteans*, slaty-blue, six inches long 6, nearly white, three inches long 1, numerous castings 11, 18; *Sipunculoids* 8, 11; *Sagitta flaccida*, *S. tenuis*; *S. hispidus* 12; *Oligochaete* 14, 16; *Polychaete* 1, 3, 5, 6, 7, 8, 10, 11, 12, 17, 18.

Clymenella-like egg capsules 1, 17; two forms of *Trochophores* 12.

Mollusca: *Pinna* 9, 10; three species of large conchs 9, one of these also at 5, 11; *Octopus*, a large, light-coloured form 7, 10, a small dark form 1, 8; *Boat-shell* 5, 9; *lamellibranch* with long siphons 4, 5; *Gastropods* 3, 15, 16; *Land snails* 11, 14, 15, 16; *Slugs* 11, 14, 15, 16, 19; *Aplysia*, a large yellow and black form 9, a small greenish and black form 1, 6, 7, 11; *Chiton* 1, 4, 7, 10, 11, a smaller "woolly" form 10; *Fissurella* 1, 7, 10; *Small prosobranchs* 1, 11; *Nerita*? 1; *Oliva*?, *Venus*-like form 11, 17; *Oysters* 18; *Mussels* 18; *Large black tectibranch* 18; three nudibranch forms, two at 1, and two at 7; *Heteropod*, *Pteropod*, shelled *Gastropod veliger* and peculiar *Gastropod*-like form with retractile anterior region 12.

Crustacea: fresh water shrimp and crabs 15, 19; rock-boring barnacles 10; *Alpheus*? 10, 17; long-legged crab 10; *libinia*-like crab 1, 7, 17; *Callinectes*; 18; *Grapsus* 1, 7; *Gonodactylus* 1, 7; *Red decapod* with chelæ on 3d periopods 1, 7; *Phyllosome* larva of *Palinurus* 12; *Copepods* 12; hermit crabs 11, 16, 19; *Hippa*, white form 7, brown species 4; *Gelasinus* 4; *Lucifer* 12; *Stenopus hispidus* 1, 11, 17; small shrimp 12; *Erichthus* larva 12; *decapod* with yellow abdomen and white cephalothorax 1; *Panularis Americannus* 1, 10; *Zoëas* and *megalops* 12; *Ostracods* 12; "woolly" larva 12; *Calappa marmorata* 5.

Tracheata: *Peripatus* 11; *Phrynus* 16, 19; *Pseudoscorpions* 15, 16; *Scorpions* 11, 14, 16; *Centipedes* 3, *Beetles* 15, 16.

Tunicata: *Appendicularia* 2; *Botryllus*? 9; yellowish, compound ascidian 6; reddish compound ascidian 1.

Pisces: small, brightly colored fish 10; fish eggs 12; "Tobacco fish" 11; *Muraena* 8; small pipe fish 12; ribbon-like fish 12.

Amphibia: tree frogs 11, 15, 16; large toad 16.

Reptilia: lizard eggs 3, 15; lizards 14; a small snake 16.

III.

From some notes on dredging and surface collecting we select the following as indicative of what is to be expected from such methods of collecting at Port Antonio.

July 28th, 4.15 a. m. to sunrise, about 5.30, collecting with tow net at the mouth of the Harbor and off Navy Island yielded: *Copepods* (more numerous than in night towing); *zoëa*, blue shrimps, *phyllosome* larva, a few large *Lucifer* with no eggs, numerous transparent *Isopods*?, *Trichodesmium*, very abundant, a young anemone, one sort of Siphonophore, two *Ephyrae*, two or three kinds of *Hydromedusae*, compound Radiolarians, *Campanularian* on piece of weed, two or three *Salpa*, one or two *Planarians*, *Sagitta flaccida*, very abundant, one or two *S. hispidus*, two or three *Heteropods*, two or three very large *Tornariae*, several *Trochophores*, fifteen *Charybdeas*, fish eggs not very common.

Two days later with the same off-shore wind and less high rollers, the collecting at the same time and place was similar to the above but less rich in forms of interest. Towing within the Harbor (4-4.30 a. m.) on this latter

date yielded *Trichodesmium*, *Sagitta hispida* and *S. flaccida*, zoëas, of *Porcellana* and of other crabs, fish eggs, ostracods, copepods, small shrimp, small *Hydromedusæ*, three small *Charybdeas*, *Mysis*, two small *Erichthus*, annelid larvæ.

Towing at the bottom with fine net August 11th, in East Harbor yielded: small Amphipods, black Isopods, small Copepods in great numbers and fewer large ones, several *Sagitta tenuis*, *Trochophores*, few *Mysis*, several small *Anthomedusæ*, Annelid larvæ, *Veligers*, several *Sagitta hispida*, larva of *Polyzoa*?

Dredging in East Harbor in four or five fathoms yielded: several species of crabs and shrimp, amphipods, sponge with *Alpheus*-like crustacea, Sertularian, *Charybdea*, living *Astræidæ*, ophiurid, *Toxopneustes*, *Spatangoid*, *Synapta*, *Gasteropods*, *Strombus*, nudibranch eggs, *Tellina*, *Venus*?, *Pecten*, *Tapes*?, *Arca*, *Cardium*, *Aleyonidium*, *Perophora*, small red *Chaetopods*, flounder.

Dredging in Bryan's Bay yielded: sponges, *Pennaria*, *Ophiurids*, *Hipponoë*, *Brissus*?, *Mülleria*, *Stylocopus*, *Cidaris*, *Diadema setosum*, *Toxopneustes*, several kinds of *Chaetopods*, *Cerithium*, *Tapes*?, *Bulla*, *Venus*, *Strombus*, *Cardium*, *Arca*, *Tectibranch*, *Pecten*, *Pinna*, small *Gasteropods*, small *Calappa*, *Cladocera*, *Dromidia* and other crabs, *Ascidians*, pipe-fish.

DEGREE OF DOCTOR OF PHILOSOPHY.

Considerable interest having been manifested with respect to the age at which young men take their degrees, the following statistics have been compiled with reference to the degree of Doctor of Philosophy. The figures for 1898, published last Spring, are here reproduced for purposes of comparison.

1899.

The degree of Doctor of Philosophy was conferred in 1899 upon forty-two candidates.

Twenty-two had resided here but three years, the minimum period of University residence required by the rules. Of these, seventeen had been out of college four years or more, many of them having devoted at least one year to graduate work elsewhere; of the remaining five, four were Johns Hopkins Bachelors of three years' standing, and one had had exceptional opportunities for advanced study during his college course.

One had resided here three years and a half; nine, four years; three, four years and a half; two, five years. One had spent only two years and a half here; three had been here only two years; one, only one year. All of the last five had pursued graduate work elsewhere, and all but one had been out of college four years or more. Of the whole number graduated, five had been out of college fifteen years or more, and two others at least ten years.

The average period of residence is 3.3 years. The average period since graduation from college is 7.4 years.

1898.

The degree was conferred in 1898 upon thirty-six candidates.

Nineteen had resided here but three years, and all of these had been out of college four years or more, many of them having devoted at least one year to graduate work elsewhere.

One had resided here three years and a half; six, four years; three, five years; one, five years and a half; two, six years; one, seven years (interuptedly). Three had spent only two years here; but all of these had given one year or more to graduate study elsewhere, and only one had been out of college less than four years.

The average period of residence for 1898 is 3.4. The average period since first graduation is 6.5 years.

January 1, 1900.

Dr. John H. Latané's lectures on The Diplomatic Relations between the United States and Spanish America will be issued early in April by The Johns Hopkins Press. They will constitute the first volume of the Albert Shaw Lectures on Diplomatic History that have been sustained by Dr. Albert Shaw, of New York.

THE TWENTY-FOURTH COMMEMORATION DAY.

The annual commemoration day of the University was observed on Thursday, February 22, 1900.

The public exercises were held in McCoy Hall at eleven o'clock. The trustees and faculty, accompanied by their guests and escorted by the students, entered the hall in procession.

The prayer was offered by Rev. E. B. Niver, of Baltimore.

The Harvard Club of Maryland, by Professor W. S. Thayer, M. D., presented to the President of the University a replica of the official chair of the President of Harvard University. The chair was accepted on behalf of this University by President Gilman.

Professor Gildersleeve, on behalf of the Faculty of the University, read an address to President Gilman, congratulatory upon the twenty-fifth anniversary of his entrance upon the office of President of the University.

An address was then delivered by President Benjamin Ide Wheeler, of the University of California, on The Duties of the University toward the Commonwealth.

The degree of Doctor of Philosophy was conferred upon Rev. Adolph Gutmacher (A. B., University of Cincinnati, 1887) of Baltimore, and John Charles Olsen (A. B., Knox College, 1890 and A. M., 1893) of Illinois.

The degree of Bachelor of Arts was conferred upon the following candidates: Henry Bogue, of Baltimore, Lyttleton Morgan Chambers, of Baltimore, Albert Keidel, of Catonsville, Maurice Lazenby, of Baltimore, James Girvin Peters, of Baltimore.

Music was rendered, during the exercises, by an orchestra of twenty musicians, under the direction of Mr. Edwin L. Turnbull, of the class of '93, and by the University Glee Club, with Mr. J. Girvin Peters as leader.

The Alumni Association held its annual business meeting in McCoy Hall in the morning, and elected the following officers to serve for the ensuing year: President, Geo. Dobbin Penniman, A. B., '84; Secretary, Alfred Jenkins Shriver, A. B., '91; Treasurer, Henry Oliver Thompson, A. B., '87; Members of the Executive Committee, William J. A. Bliss, Ph. D., '94; William Henry Perkins, Jr., A. B., '84; Waldo Newcomer, A. B., '89; Redmond Conyngham Stewart, A. B., '92; Douglas Hamilton Thomas, Jr., A. B., '93; John H. King, A. B., '99.

The Annual Alumni dinner was held at the Hotel Rennert in the evening. Addresses were made by President Gilman, President Wheeler, Hon. Thomas G. Hayes, Mayor of Baltimore, Mr. C. Morton Stewart and others.

The Twenty-fourth Annual Report of the President of the Johns Hopkins University has just been issued. It contains 116 pages, octavo, and includes, in addition to the President's Report, Reports on the Instruction in the Chief Branches of Study, and other supplemental matter.

Of the Memoirs from the Biological Laboratory, Volume IV is now completed. The contents of the volume are as follows:

The Cubomedusæ. By Franklin Story Conant, with eight folio plates. *Synapta Vivipara*. By H. L. Clark, with five folio plates.

Yoldia limatula. By Gilman A. Drew, with five folio plates.

Physiology and Histology of the Cubomedusæ, including Dr. F. S. Conant's Notes on the Physiology. By E. W. Berger, with three folio plates.

Ophiura brevispina. By Caswell Grave, with three folio plates.

No. 4 of Volume XX, of the American Journal of Philology (to appear this month), will contain an index to Vols. XI to XX of that Journal. There has also just been issued a detailed index to Vol. XI to XX of the American Chemical Journal, prepared by Dr. J. Elliott Gilpin.

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